DECLARATION UNDER 37 CFR 1.132

I, Dr. George C. Valley, do hereby declare I received a Ph. D in Physics from the University of Chicago in 1971. I was also a Principal Research Scientist and Department Manager at HRL Laboratories, LLC from 1980 to 1998. I am currently a Senior Scientist at the Aerospace Corporation. As such, I have over 20 years of experience in the numerical solution of time-domain equations for physical systems. Thus, I hereby affirmatively state that I am an expert in the field of numerical solution of time-domain equations for physical systems. As an expert in the field of numerical solution of time-domain equations for physical systems, I am exceedingly qualified to comment on U.S. Patent Application No. 10/685,352 (hereinafter referred to as the '352 application), which is in said field.

George C. Valley 13 Dec 2007

The Sangiovanni-Vincentelli publication is not relevant to the claims of the '352 application because it considers just analog or RF circuits and contains no time-domain simulations. An invention according to the '352 application applies to time-domain simulation of mixed signal circuits - circuits with both digital and analog or RF subsets. In particular, the Sangiovanni-Vincentelli publication will not involve the highly discontinuous non-linear operations of the digital clock that are one of the main reasons the method claimed in the '352 application is needed.

Furthermore, an invention according to the '352 application is faster than the time marching algorithms because the discontinuity is modeled at the clock period in the circuit response with a single wavelet basis at each iteration, while the time-marching algorithm must subdivide into many hundredths (100s) of time steps to accurately march up the nearly discontinuous change in the state variables at the clock period.

Previously, wavelet techniques could not be applied to mixed signal circuits. This is because previous wavelet techniques (prior to the '352 application) using 64 wavelets per clock period for 2^{14} clock periods yields a requirement of over 1

million wavelets for the full circuit simulation. Such methods would be very slow because of the number of wavelets involved and cannot converge when nonlinear effects are included because the nonlinear effects in the first clock period influence the response in all subsequent time periods.

Upon a review of the Office Action dated August 13, 2007 (for the '352 application), I believe that the Examiner is confused when he states that the invention uses a larger clock time period. The clock time period is a property of the circuit to be simulated and not of the method disclosed in the '352 application. The method in the '352 application uses the wavelet-based matrix operator approach in a single clock period, which does not exist in any of the literature that I or the Examiner cited as prior art. Because the wavelets are fit to the basic response of the circuit in the clock period, a rather small number of wavelets can be used in each clock period. The amount of time taken by the simulation is proportional to the number of wavelets in the method (according to the '352 application) and to the number of time steps needed in a clock period in the time-marching method. However, the number of time steps in the time marching method must be orders of magnitude greater than the number of wavelets for the same accuracy, as it can be seen in figures 5 and 6 of the '352 application, where several simulations were performed comparing the time marching method against the wavelet method disclosed in the '352 application. The simulations shown in figures 5 and 6 indicate that the typical number of time marching steps was much larger than the number of wavelets used for the same accuracy.

Regarding the Chang publication, the method disclosed in the '352 application uses the Galerkin method only within a clock period to determine the best Wavelet basis for the wavelet-based matrix operator. Alternatively, the Chang publication uses the Galerkin method to solve a spatial boundary value problem, not a time-domain initial value problem. The Galerkin method is completely inapplicable to time-domain initial value problems.

The fact that Wavelets are used to solve differential equations is well known. The fact that Galerkin's method is used to solve differential equations is well known. However, none of the cited prior art, to the best of my knowledge, discloses how to make a matrix operator to use over a clock period to speed up the simulation of mixed signal circuits, which are defined to include nonlinear analog components and sharp time variations at the clock period of the digital part of the circuit.

The Chang publication uses two boundary conditions at both ends of the semiconductor device because it is a Galerkin method. It is analogous to the method (in the '352 application) in the time domain over a single clock period, but in no way analogous to the method (in the '352 application) over the entire time domain. The Galerkin method presented in the Chang publication cannot be used for time domain simulation over the entire time domain because there is no known boundary condition at the final time of the simulation.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

George C. Valley
Dr. George C. Valley
Senior Scientist
Aerospace Corporation

13 Dec 2007
Date